THE WEATHER AND CIRCULATION OF JANUARY 1962

A Month With Large Circulation Changes and Widespread Cold

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1. INTRODUCTION

Marked variability in the circulation from week to week was responsible for abrupt changes in the weather in the United States in January 1962.

The early part of the month was generally mild across most of the country, but sudden amplification of the Pacific ridges in the second week resulted in the most severe cold weather in many years. Widespread cold continued through the third week during a brief period of blocking and was followed by a warming trend east of the Rockies in the last week. Record January snowfall was reported in parts of the East, in the Great Plains, and in the Far West.

2. MONTHLY MEAN CIRCULATION

In January, blocking was confined principally to the Pacific area (fig. 1) while in December [1] it had been a strong, persistent feature of the circulation over both oceans. A consequence of the collapse of blocking in the Atlantic was an extensive area of height falls and the appearance of a negative height anomaly (up to 640 ft. in Davis Strait) from Hudson Bay to Scandinavia. These falls, along with the simultaneous height rises of the same magnitude in the central Atlantic, produced a strongly reinforced westerly flow and a northward shift of its axis of maximum speed some 10° of latitude farther north than in December (fig. 2). Indeed, the westerlies were stronger over the Atlantic than in any other place in the Northern Hemisphere.

Under the influence of blocking in the Atlantic in December the wavelength from the trough in North America to the trough in the Atlantic was only about 50° of longitude. In January (associated with wind speeds of 4 m.p.s. to 6 m.p.s. stronger than normal) the distance from the trough in North America to the next trough eastward was twice as great, about the same as usually observed.

The trough in Eurasia was somewhat weaker than normal, but the vortex over Novaya Zemlya was the most intense Low in the Northern Hemisphere. The combined effect of this deep Arctic Low and the ridge near Lake Baikal helped maintain westerlies as fast as 16 m.p.s., about twice the normal speed.

The trough southward from the Sea of Okhotsk was considerably deeper than normal. Deepening of this trough frequently supports the simultaneous development of a ridge in the central Pacific, but in January this interaction did not occur since the circulation was complicated by blocking in high latitudes. Blocking and above normal heights in the Bering Sea were accompanied by westerlies displaced as much as 10° of latitude south of normal (fig. 2) and by below normal heights south of 40° N. from Asia to the Central Pacific. The lower portion of the trough in the Central Pacific was well below normal, but in higher latitudes, heights in the trough were greater than normal in an area where the probability of troughs in January is less than 10 percent [2].

Another important feature of the circulation was the consolidation of the blocking ridge with a ridge in the eastern Pacific. The result was marked amplification of the ridges from 20° N. to the Polar Basin and a strong northerly anomalous flow from Alaska to the Mexican border (fig. 1). This flow was a controlling factor in the weather in the United States in January.

3. AVERAGE MONTHLY WEATHER

TEMPERATURE

An unusual aspect of the average January weather in the United States in 1962 was the wide distribution of colder than normal temperatures (fig. 3). There have been many Januaries when temperatures averaged much colder in certain sections of the country, but seldom has colder than normal weather been so widespread. In fact, since 1933, only January 1957 was predominantly cold from the west coast to the east coast.

In the Mississippi Valley average temperatures ranged from 4° to 8° F. below normal where 700-mb. heights were below normal. In the Rockies and the Great Basin mean temperature anomalies were similar even though 700-mb. heights were above normal. But the West was dominated by a strong northerly anomalous height component that was responsible for vigorous injections of very cold Arctic air into the United States. Most of this was transported eastward and southward through the mean trough, but some moved across the Rockies and into the Great Basin.

The 1000–700-mb. thickness anomaly chart (fig. 4) is perhaps more indicative of the generally cold conditions than either the 700-mb. flow or the flow anomaly. In figure 4, below normal thickness is nearly coincident with colder than normal temperatures.

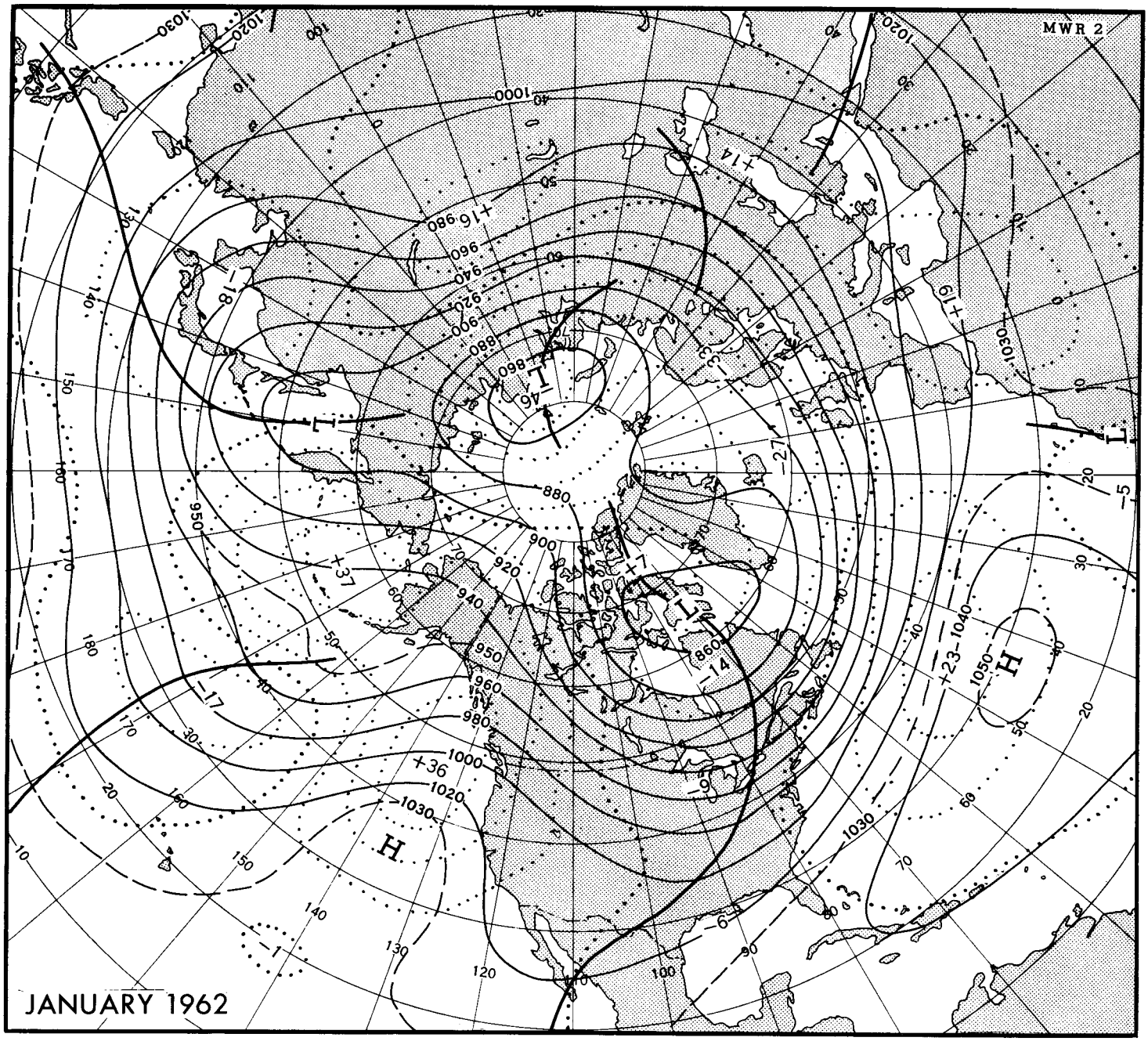


FIGURE 1.—Mean 700-mb. contours (solid) and height departures from normal (dotted) (both in tens of feet) for January 1962. High index conditions prevailed in northern portions of the Atlantic, Europe, and Asia, but low index was dominant in the Pacific and North America.

PRECIPITATION

From the Plains westward precipitation amounts (fig. 5) were generally less than 1 in. except along the west coast where amounts ranged from 2 in. in California to 6 in. in Washington. For the most part these totals were less than normal, which is usually true when the anomalous height flow is northerly. Eugene, Oreg. is a good example. Here precipitation amounted to only 1.39 in. which was almost 5 in. less than normal, a new January record for dryness.

TABLE 1.—*New records for total snowfall for January established in 1962.*

Station	Snowfall (in.)	
Winston-Salem, N.C.	18.9	
Spartanburg, S.C.	9.9	
Muskegon, Mich.	66.6	
Topeka, Kans.	18.0	
Lander, Wyo.	26.5	
San Francisco, Calif.	1.5	(All time airport record)

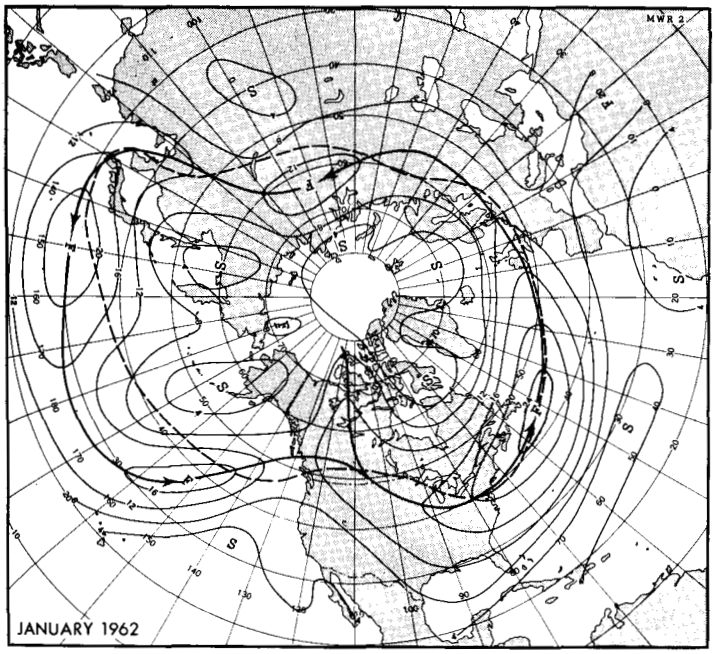


FIGURE 2.—Mean 700-mb. isotachs (meters per second) for January 1962. Solid lines are principal axes of maximum wind speed and dashed line the normal January position. The most marked deviation of the "mean jet" was in the Pacific where the influence of blocking was appreciable.

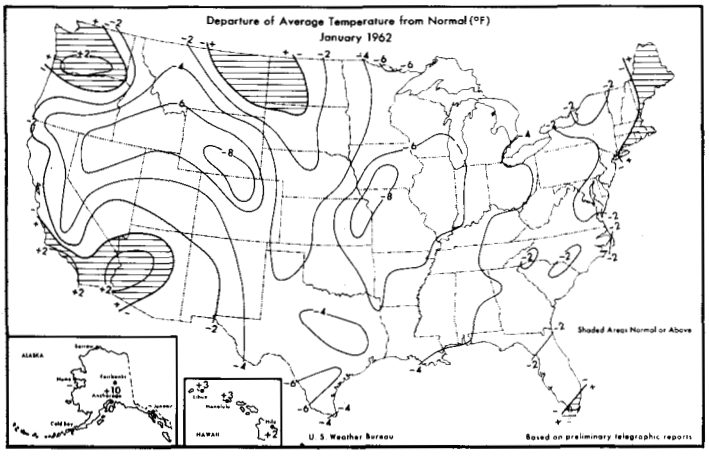


FIGURE 3.—Departure of average surface temperature from normal (°F.) for January 1962 (from [4]). Such widespread cold weather is an infrequent January occurrence.

Heaviest precipitation occurred in the Southeast where accumulations of 4 to 10 in. over a broad area were as much as twice the normal. Charlotte, N.C., had the wettest January of record when precipitation totalled 7.44 in., nearly 4 in. in excess of normal. Heavy precipitation was favored by the upper-level trough to the west, southerly anomalous height contours, and the southwesterly flow overriding cold air in the lower layers.

Snowfall in January was widespread and in some instances of record proportions as shown by the stations listed in table 1. In addition, a trace of snow was reported

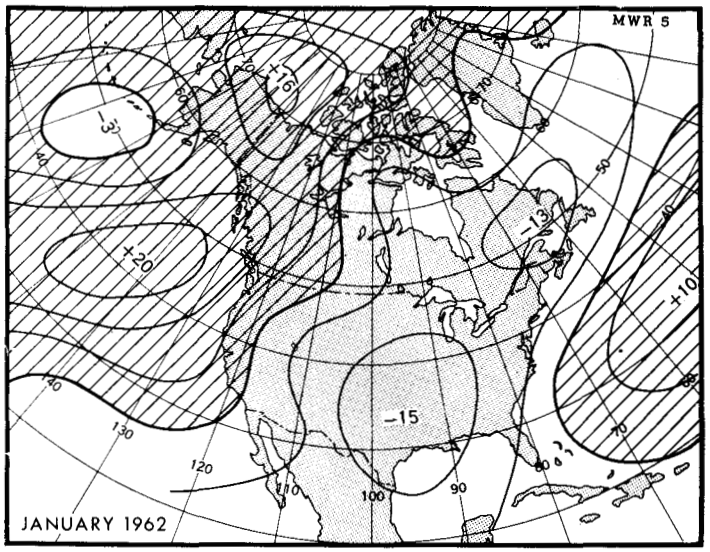


FIGURE 4.—Mean 1000–700-mb. thickness departure from normal (isopleth interval 50 ft.) for January 1962. Lower than normal thickness over most of North America was associated with the vigorous amplification at 700 mb.

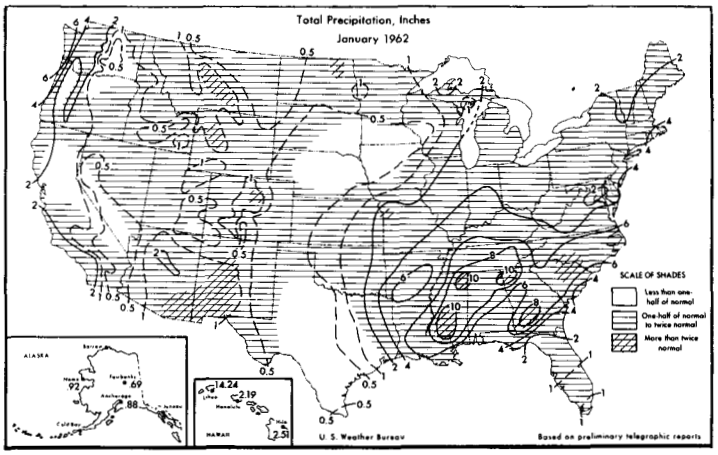


FIGURE 5.—Total precipitation (inches) for January 1962 (from [4]). Precipitation was especially heavy in the Southeast where locally severe flooding was reported.

at such southerly locations as Pensacola, Fla., Phoenix, Ariz., and Long Beach, Calif.

The severity of the weather in January is not wholly apparent from the averages since there were periods during the month when abrupt changes in the circulation produced notable extremes in the weather. The intramonthly variability shows up quite clearly when the month is considered week by week.

4. WEEKLY ASPECTS OF THE WEATHER AND CIRCULATION

WEEK ENDING JANUARY 7

The 700-mb. mean flow during the first week [1] of January (fig. 6a) was quite fast from British Columbia to

[1] For this add subsequent weeks 5-day mean charts centered at mid-week are considered representative of the week.

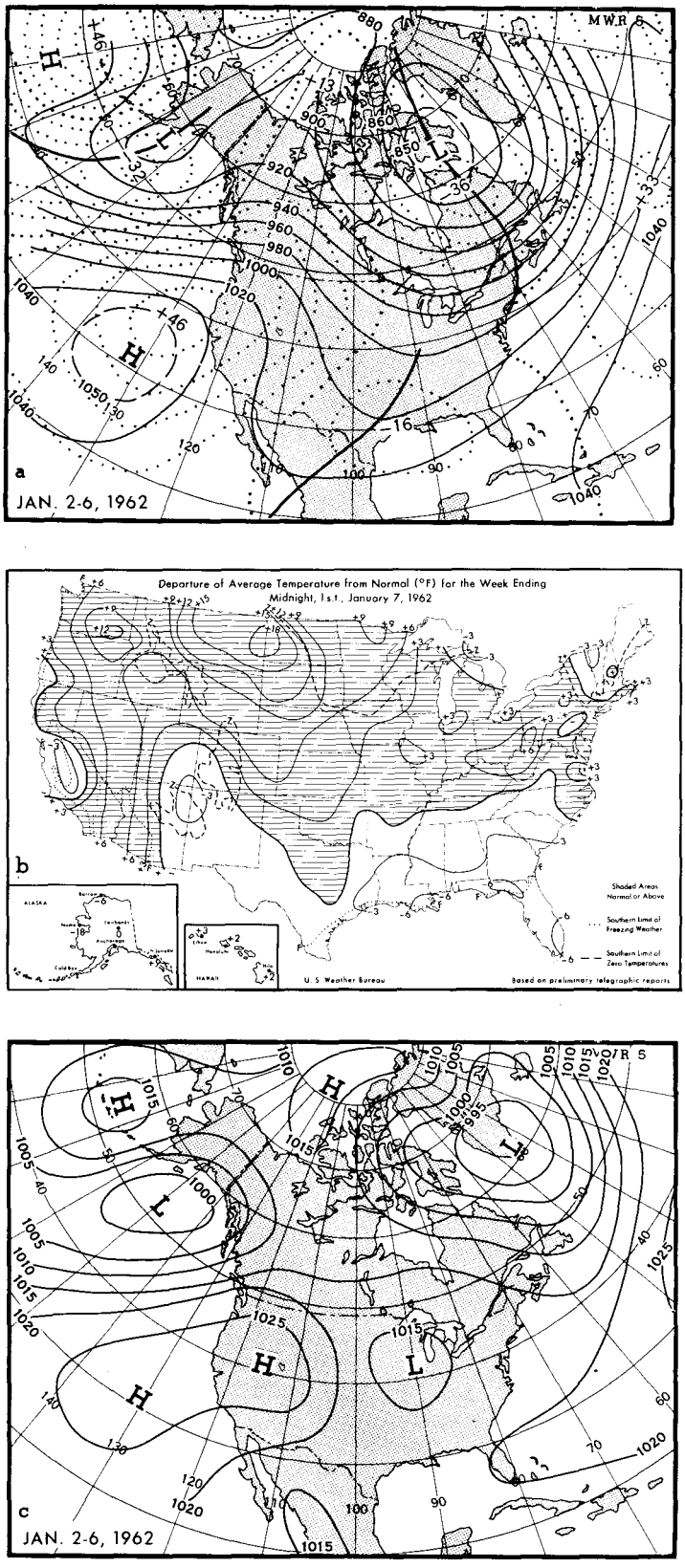


FIGURE 6.—January 2–6, 1962. (a) Mean 700-mb. contours (solid) and height departures from normal (dotted) (both in tens of feet); (b) departure of average surface temperature from normal (°F.) (from [4]); and (c) mean sea level isobars (in millibars). Unseasonably mild weather over the United States was associated with a flow that was principally zonal along the Canadian border.

the Great Lakes and eastward. Judging from the contours alone, the warm ridge in the Great Basin was apparently joined to the high-latitude ridge to the north. But the anomalous height contours indicate some separation of the ridges (50°–60° N.) and a westerly component greater than normal. These fast westerlies were basically responsible for the sheared character of the trough in the East. This shearing is further indicated by the height anomaly that shows one negative center in Quebec and another on the Texas coast.

The overall impact of the circulation on the temperature is shown in figure 6b. Since westerly flow predominated near the Canadian border, there was little chance for continental air masses to penetrate the United States. Thus, most of the country was influenced by mild Pacific air and mean temperatures for the week were relatively warm. Maximum departures were as much as 18° F. above normal in eastern Montana and western North Dakota and up to 12° F. warmer than normal in Washington.

In contrast, temperatures ranged from 3° to 6° F. colder than normal in the South and Southeast. Freezing temperatures were common along the Gulf coast with frost extending into the Everglades, and on January 3, there was frost in the suburbs of Miami, Fla.

Principal storminess in this period consisted of a Low that entered British Columbia (see Chart IX of [3]) and moved into the Plains. It redeveloped in southern Oklahoma, then became an intense cyclone in the mean trough near the Great Lakes. This storm was responsible for over 2 in. of rain in the Southeast, a severe glaze in New England, and blizzard conditions in parts of the Midwest.

The 5-day mean sea level chart for this week (fig. 6c) shows clearly some of the items discussed above. Note the warm High over the Basin and its separation from the cold High to the North, the absence of northerly flow from a cold source, and the cut-off appearance of the mean Low in the Midwest.

WEEK ENDING JANUARY 14

Retrogression was the important factor of the second week's circulation (fig. 7a). The Aleutian Low reformed over the western Bering Sea as the ridge in western North America retrograded and strengthened. Meanwhile, the trough in eastern Canada became more intense and joined with the trough previously in the Mississippi Valley. This evolution produced a northerly anomalous flow from the Beaufort Sea to Mexico as indicated in figure 7a. Implicit in this flow was the change from mild temperatures in the United States to severe cold (fig. 7b). The only areas not affected were parts of the Pacific Northwest and Maine where temperatures were warmer than normal.

Early in the week a massive Arctic High plunged southeastward from Alberta along the Divide and then spread over most of the nation. This record-breaking High produced average temperatures for the week that were 15°–

20° F. below normal over a large area in the south and central portions and along the Rockies. This was the worst cold wave since 1899 in the Gulf Coast States. There were numerous daily records for minimum temperature established in the Plains States, the southern Rockies, and the South. Examples of extreme average daily temperatures are: Denver, Colo., 42° F. below normal on January 9; Texarkana, Ark., 38° F. below normal on the 10th; and Mobile, Ala., 36° F. below normal on the 11th.

During the second week of January there were also new all-time minimum temperatures for January in the following cities: Roswell, N. Mex. (−24° F.), Midland, Tex. (−8° F.), and Baton Rouge, La. (10° F). At the other extreme Oakland, Calif., reported a record maximum temperature for January of 75° F.

The highest sea level pressure ever observed in the United States occurred in Montana where pressures exceeded 1061 mb. (See Weather Note, p. 174.) Individual station records were broken in many cities from Montana to Texas as this unprecedented cold dome passed.

After the cold High weakened on its path to the Southeast a storm traveled from the Great Basin to the Southern Plains and into the Ohio Valley [3]. This Low was accompanied by rain and snow and another outbreak of Arctic air near the end of the week. A weak coastal disturbance caused heavy rain in eastern North Carolina and 5 to 9 in. of snow in southeastern Virginia.

Average sea level pressures for the week show the extensiveness of the ridge that dominated the United States (fig. 7c). Note the virtual absence of flow from any warm air source, a situation practically opposite to the sea level flow of the previous week (fig. 6c). It is of some interest that the daily Low that came out of the West and traversed the mean High in the Southern Plains did not deepen until it reached the mean 700-mb. trough in the Ohio Valley.

WEEK ENDING JANUARY 21

Blocking at high latitudes characterized the circulation over North America this week (fig. 8a). 700-mb. heights were as much as 1,350 ft. above normal over Alaska where a High in excess of 10,500 ft. was observed on the representative 5-day mean chart. This High was sustained to a large extent by deepening near 30° N. in the central Pacific. As a result of amplification and the spread of blocking from Alaska to Greenland the cyclonic center of action in eastern Canada was displaced southward and a broad cyclonic sweep of the mean 700-mb. contours occurred across the United States.

Temperatures during the third week of January (fig. 8b) were still below normal over most of the country, but there was a decided warming in the Southeast since Arctic Highs were steered eastward during this period instead of southeastward. This warming is further indicated by the slightly positive height anomalies in the southeastern third of the nation.

Very cold air covered the Central and Northern Plains

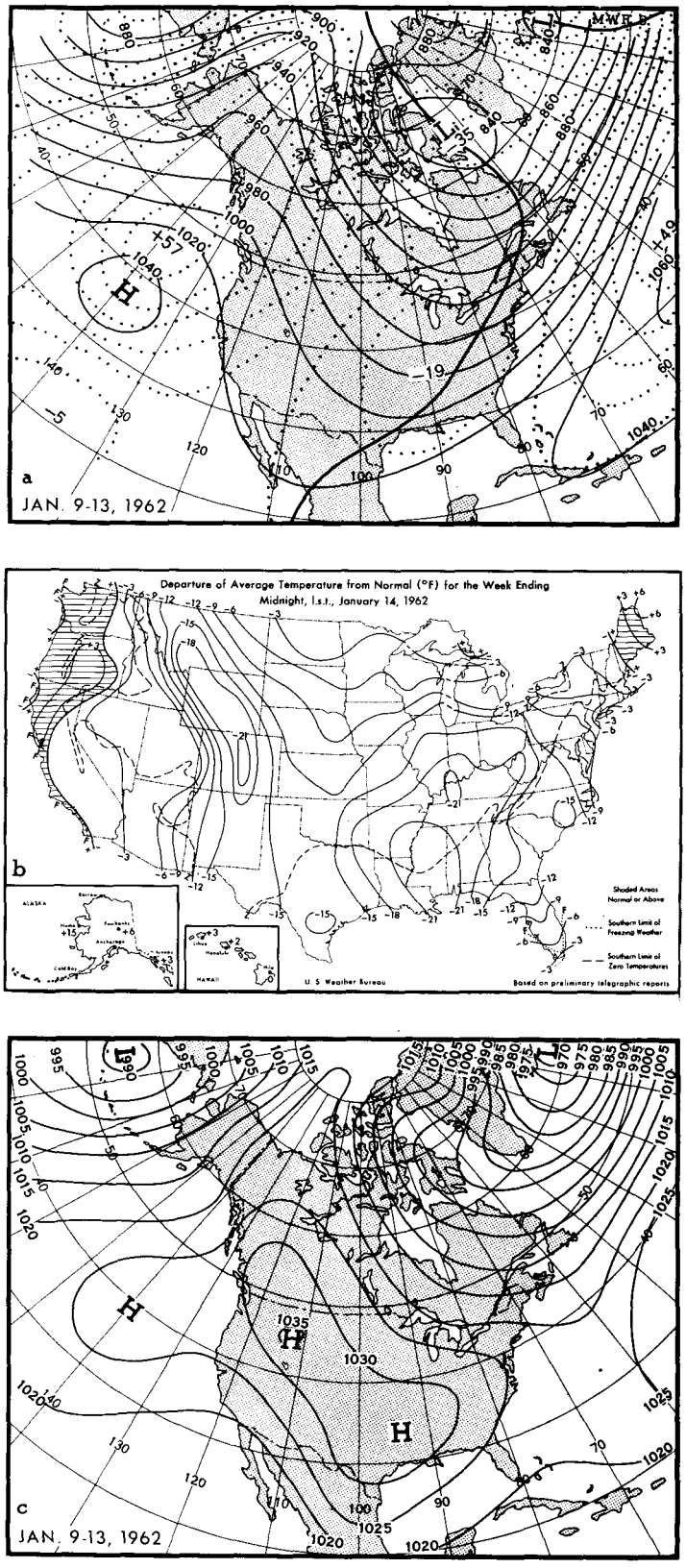
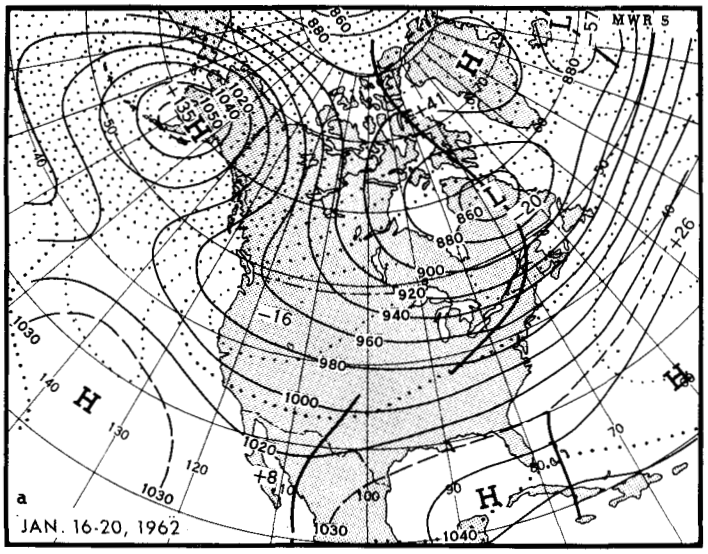
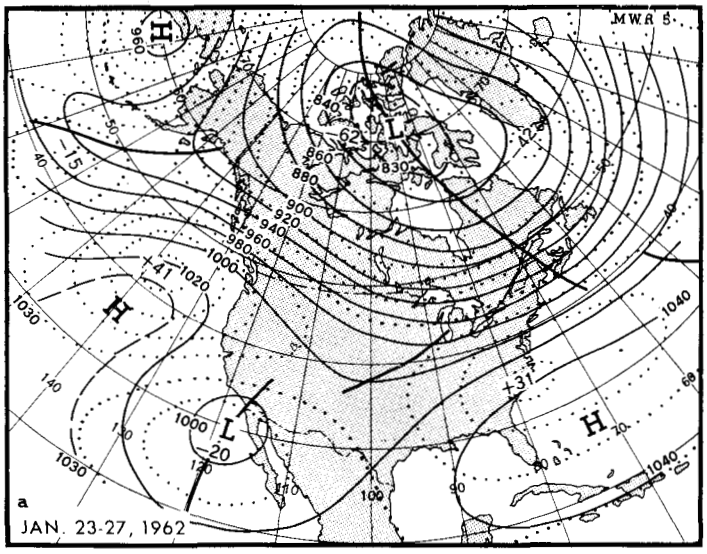
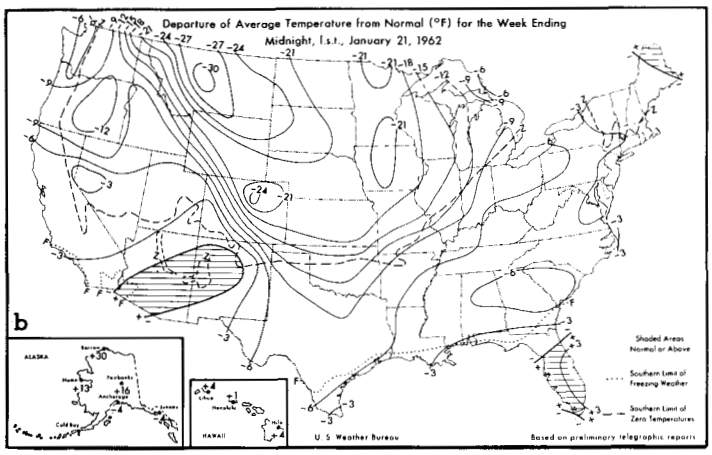
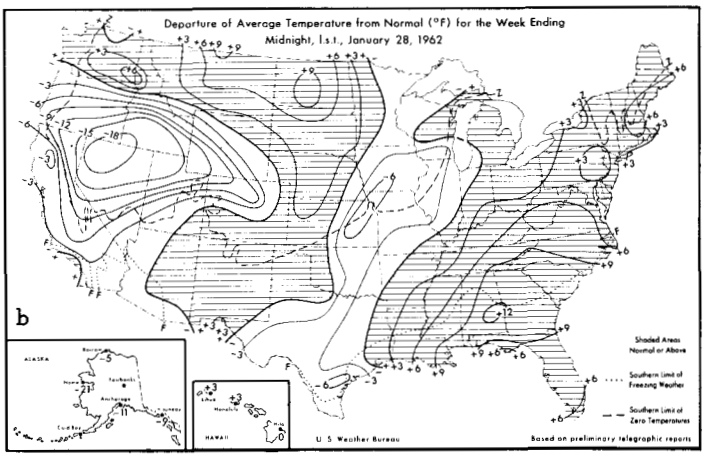


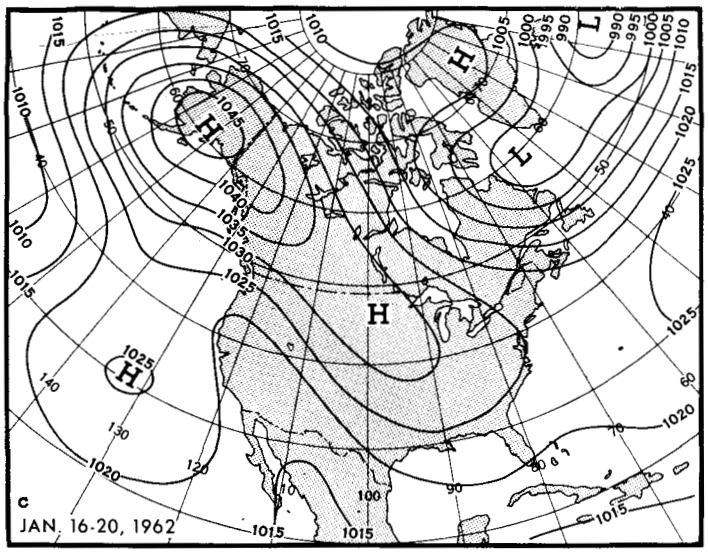
FIGURE 7.—January 9–13, 1962. (a) Mean 700-mb. contours (solid) and height departures from normal (dotted) (both in tens of feet); (b) departure of average surface temperature from normal (°F.) (from [4]); and (c) mean sea level isobars (in millibars). The most severe cold wave in many years occurred this week as strong meridional flow dominated the circulation.











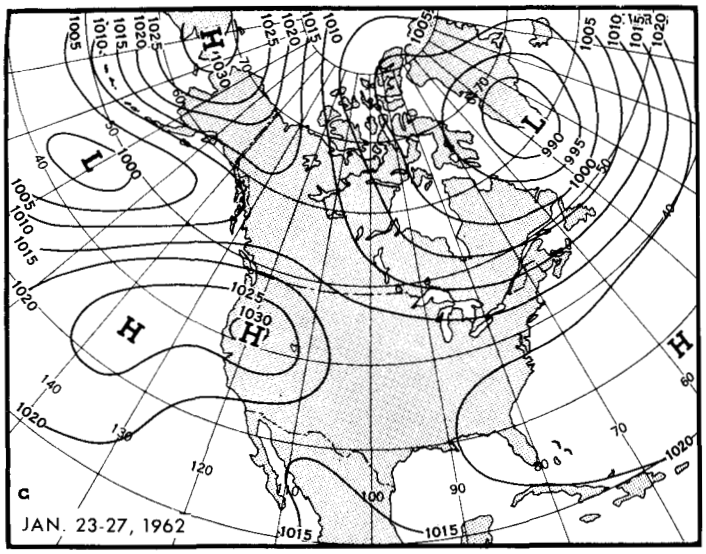


FIGURE 8.—January 16–20, 1962. (a) Mean 700-mb. contours (solid) and height departures from normal (dotted) (both in tens of feet); (b) departure of average surface temperature from normal (°F.) (from [4]); and (c) mean sea level isobars (in millibars). Pronounced blocking and continued cold weather characterized this week.

FIGURE 9.—January 23–27, 1962. (a) Mean 700-mb. contours (solid) and height departures from normal (dotted) (both in tens of feet); (b) departure of average surface temperature from normal (°F.) (from [4]); and (c) mean sea level isobars (in millibars). A warming trend occurred as blocking receded and a westerly flow returned.

with temperatures averaging 30° F. below normal in Montana. At the same time, associated with the warm High over Alaska, the temperature at Barrow was 30° F. warmer than normal. West of the Divide temperatures were 3°–12° F. below normal from Washington to Arizona. All-time record cold occurred at Burns, Oreg. when the temperature reached −24° F. on the 21st.

Principal cyclonic activity this week was in the West. An intense Low entered northern California and deepened to below 985 mb. over Nevada, then weakened as it moved southward [3]. During the passage of this Low heavy snows fell on the western ranges in varying amounts up to 30 in. Lighter amounts fell in the Central Valley of California and up to 4 in. was reported near San Francisco. Also associated with this storm was an all-time low pressure of 986 mb. at Elko, Nev.

Five-day mean sea level pressure exceeding 1045 mb. occurred in Alaska (fig. 8c) when the blocking High at 700 mb. was at a maximum. During this week many stations in Alaska had all-time high sea level pressures. Highest reported, but not a record, was at Fairbanks (1058 mb.). The ridge southeastward through western Canada to the High in North Dakota was still strong this week except in its southern and southeastern sections.

Despite the depth of the Low that entered the West the only evidence of its effect on the mean sea level chart was the general pressure falls of 5 to 10 mb. in the cyclonic area in the Southwest. There are two reasons for this: first, the Low was deep on only one day, then filled 28 mb. in the next two days; second, the Low contributed to this mean for only 30 percent of the 5-day period.

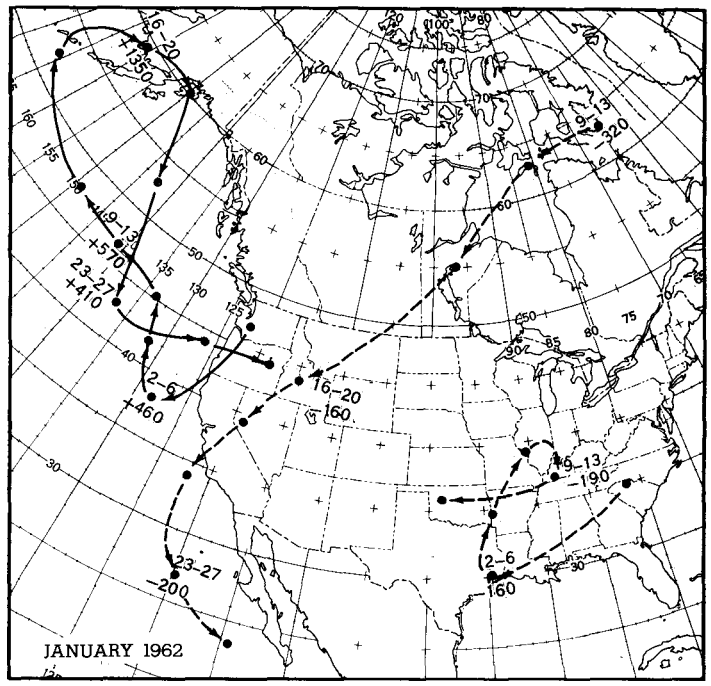


FIGURE 10.—Tracks of principal 5-day mean 700-mb. height departure from normal centers in January 1962. Positions of centers one week apart are indicated by solid circles and labeled with intensity and the 5-day period representative of each week. Intermediate positions are unlabeled solid circles. Note that the negative centers (dashed arrows) followed tracks to the southwest as the positive centers (solid arrows) moved northwestward.

WEEK ENDING JANUARY 28

As blocking left North America this week (fig. 9a) mean 700-mb. heights decreased as much as 1,000 ft. in Alaska and northwestern Canada. The High formerly over Alaska (fig. 8a) weakened and retrograded to the Bering Sea, but in middle and low latitudes the ridge moved eastward. Meanwhile, activity formerly in the central Pacific at low latitudes was transferred to the Gulf of Alaska to form a circulation pattern somewhat similar to that of the first week (fig. 6a).

Associated with these changes in the circulation was strengthening of the westerly flow in mid-latitudes across North America and height rises over much of the United States. A reaction to this high index flow was a 10°–30° F. temperature increase east of the Rockies.

Very cold air spread over most of the Far West as an Arctic High settled slowly over the Great Basin. At Winnemucca, Nev., the temperature averaged 19° F. colder than normal and freezing temperatures were reported along the California coast as far south as Santa Maria.

Given the observed and anomalous 700-mb. flow (fig. 9a) it may seem strange that most of the West was not as warm as Washington and Idaho. The most probable reasons are: first, very rapid changes were occurring this week; second, the temperature at the surface often lags the mean circulation; and third, the snow cover in the West acted as a deterrent to sudden warming.

There is a distinct resemblance of this week's 5-day mean sea level chart (fig. 9c) to that of the first week (fig. 6c), the major difference being the closed Low in the Midwest on the latter chart. In this respect the confluence at 700 mb. in the Southern Plains (fig. 9a) was sufficiently strong to preclude a cut-off Low at sea level. On the contrary, the two storms this week moved out of the southern Rockies and rapidly off to the east and northeast [3]. Precipitation released by these storms was heaviest in the Southeast in and to the south of the upper-level confluence.

5. PATHS OF SELECTED HEIGHT ANOMALY CENTERS

Certain features of the month's weather and circulation discussed above can be interpreted from an appraisal of the paths of height departure from normal (DN) centers shown in figure 10. The negative DN center in the South was prominent during the first two weeks of January. As this center moved northward the deepest value (−470 ft., not shown) occurred in the period January 11–15, represented by the circle in Illinois. This was also the time of the severe cold wave in the Plains States and

the South. At the same time the positive height center off the west coast was proceeding northwestward.

As the negative DN diminished in the Southern Plains a new negative center appeared near Baffin Island. By the third week this DN weakened somewhat and was located in Idaho. Meanwhile the positive height anomaly reached a maximum of +1350 ft. in Alaska. Blocking was strongest, very cold air occupied the Northern Plains, and cooling was taking place in the West.

It should be noted that the West became coldest after the positive DN reached its peak in Alaska. There was a similar lag in the maximum negative value (−390 ft.) that occurred January 20–24 at 34° N., 122° W.

By the end of the month the positive DN re-entered the Pacific Northwest where warming was in progress and the negative center became quite weak near 23° N., 115° W.

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Weather Note

COLD WAVE OF JANUARY 8–11, 1962 IN MONTANA

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A few interesting particulars on the phenomenal weather development during January 8–11, 1962 as it affected Montana are:

(1). Helena observed the highest sea level and station atmospheric pressure recorded since April 1, 1880—nearly 83 years. Reduced to sea level, the pressure was 1063.3 mb. (31.40 in.), and the station pressure stood at 26.855 in. Previously the highest since 1880 had been 1054.9 mb. (31.15 in.) in November 1959.

(2). Lowest temperature observed for the State (as this is written, Jan. 11, 1962) was −55° F. at West Yellowstone, January 10. Other minima currently available show −44° at Butte on the 9th, −47° at Drummond on the 10th, and −42° at Belgrade on the 9th. In fact, the entire State appears to have been well below zero on both the 9th and 10th.

(3). The strong westerly surface winds that developed along eastern slopes on the 10th, and which continued on the 11th, failed to produce the rapid warming usually experienced under such conditions—attesting to the unusual coldness of the air mass as a whole. In fact, over 30 hours after the wind had started, only a few points had warmed to 32° F. Much blowing and drifting snow accompanied the wind.

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